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Recommendations for reforestation in areas affected by pitch canker

Landowners are frequently faced with the question of how to replace Monterey pines in areas where pitch canker is a problem. In close proximity to native stands of Monterey pine, several issues should be considered before a decision on replanting is made. First, replanting with Monterey pine may be desirable in order to maintain the character of the community and, where large tracts of land are involved, to help preserve the genetic and aesthetic resource that this species represents. Second, not just any Monterey pine will do. There are three native populations of Monterey pine in California, at Año Nuevo, Monterey and Cambria, each of which is genetically unique. Consequently, it would be a mistake to import genetic stock from outside the native population where the replanting is to occur, as it could degrade the genetic integrity of the local population. For this same reason, trees originating from breeding programs (i.e. selected for rapid growth and other commercially valuable attributes) should also be avoided. Third, although the nature and extent of variation within each Monterey pine population is not fully understood, one should assume that trees from distinct areas or habitats may be specifically adapted to the site where they occur. Thus material selected for replanting should be as local in origin as possible. Finally, in the absence of any prior selection for resistance to pitch canker, replanted Monterey pines have a high probability of sustaining infections and possibly dying from this disease. However, in all three native populations some percentage of trees will show resistance to pitch canker and the options detailed below offer some alternative means to take advantage of this. Additional background information is provided below under the heading “What is genetic resistance?”

Option 1

The preferred strategy for reestablishing Monterey pine would be to allow natural regeneration to occur. This is more likely to be practical in relatively large areas (> 0.1 acre). If local conditions, such as a dense understory preclude development of a seedling stand, various measures may be undertaken to improve the site so as to encourage regeneration. Contact your local forester or the California Department of Forestry for additional information on this. Where natural regeneration does occur, it can be expected that pitch canker will eventually infect some or all of the young trees. However, the trees will vary in their susceptibility and some may sustain little or no damage. Although this approach offers no guarantee that the frequency of resistance to pitch canker will be sufficient to provide the desired density of mature trees, it represents the least intrusive approach to reforestation.

Option 2

If option one is acceptable in principle but there is insufficient seed to produce a stand, locally collected seed could be introduced. Whereas it would be desirable to use seed from known resistant trees, no such seed source is presently available. An alternative would be to collect seed from symptomless trees, some of which may be resistant. Even if the parent tree is resistant, the seed is likely to produce a significant number of susceptible individuals. However, a small percentage of resistant individuals may be sufficient to establish a stand.

Although the planting site itself may not be in a native forest, if it is close to such a forest, the trees may eventually contribute pollen to the nearby native population. For this reason, seed for replanting should be obtained from native trees, as close as possible to the planting site. If the area to be planted is large, an attempt should be made to diversify the source of seed, by collecting cones from: 1) multiple trees, separated from each other by 100 meters if possible, 2) trees of different ages, and, 3) different heights in the same tree. Avoid collecting from any trees that appear to have been planted as they may be non-local in origin. Also try to avoid trees that are obviously infected by either western gall rust or dwarf mistletoe.

Option 3

An alternative to establishment from seed is to transplant known resistant seedlings from a reputable source. This should be viewed as a last resort to maintain the presence of Monterey pine. Local and regional efforts are underway to develop resistant planting stock for all the native populations, and these may be available in the near future. Contact your local forester or the California Department of Forestry for more current information.

What is genetic resistance?

In most areas where pitch canker is well established, it is possible to find Monterey pine trees with few or no symptoms of the disease. In some cases, these trees have simply not been exposed to the pathogen in sufficient quantities or under the right circumstances for an infection to become established. Eventually they will become diseased. However, some trees will not develop symptoms of pitch canker even when they are challenged with large quantities of inoculum under conditions that are conducive to infection. These are the trees we consider to be “genetically resistant” to pitch canker. As this term implies, resistance is determined by the genetic make up of the tree. That is, specific genes are involved in determining whether or not an individual Monterey pine is susceptible to pitch canker.

Genetic resistance has proven to be highly effective in the control of many plant diseases. However, there is never a guarantee that it will provide complete disease control in perpetuity. Over time, pathogens can adapt to resistant plants, rendering them more susceptible to disease. This can result from genetic mutations in the resident population of the pathogen or from the introduction of new strains. Where resistance in the plant host is determined by only one gene, a single gene mutation in the pathogen could allow it to overcome host resistance completely. On the other hand, where resistance is determined by many genes, a single gene change in the pathogen is less likely to have a major effect on the susceptibility of the host. Thus the number of genes that contribute to genetic resistance in the host has a direct effect on the pathogen's ability to overcome this resistance.

The genetic basis for resistance to pitch canker in Monterey pine is not yet known with certainty but the available evidence indicates that many genes are probably involved (= multigenic resistance). One characteristic of multigenic resistance is a wide range of variation in susceptibility. It is analogous to a trait such as height in humans. Some people are short, others tall, and most are somewhere in between. This reflects the fact that height is a characteristic influenced by many genes. So it appears to be with susceptibility to pitch canker in Monterey pine. Some trees are highly susceptible and will become heavily infected, others will sustain no infections, and many others will fall between these extremes. Based on such observations, it seems likely that resistance to pitch canker is determined by many genes.

Multigenic resistance tends to be much more durable than single gene resistance and offers reason for optimism that resistance in Monterey pine can provide lasting protection against pitch canker. Changes in the pathogen population will surely occur but it is unlikely that they will dramatically alter the resistance of most trees. Over the long term, the host population can change as well, maintaining a balance that will limit the disease causing ability of the pathogen. This same process occurs naturally and has allowed Monterey pine to adapt to the many insect and disease problems that are of long residence in native forests.

Given the problems with pitch canker, why plant Monterey pines at all?

In most urban environments, one may opt to avoid any risk of damage from pitch canker by utilizing non-susceptible species as landscape trees. But in a native Monterey pine forest and at the urbanized border of such a forest, planting exotic species will degrade the integrity of a limited natural resource. If Monterey pines that are lost to pitch canker are replaced with non-native tree species, the loss to the native forest will be made permanent. As an alternative, killed trees can be replaced with Monterey pines that are genetically resistant to pitch canker, thereby helping to sustain this species in its native habitat.

Where do I go to get resistant trees?

Presently there is no commercial source of resistant seed or seedlings. Several programs are in place to develop this material, which may be available in the near future. If you are interested in replanting with Monterey pine you should contact local or state agencies to determine what your best options are. A good place to start would be your city forester or U.C. Cooperative extension office.